paper code: U359-133 (TI) T.Y. B Tech (E&TC) Sem - I

Course: Communication Engineering - II

Course code: ETUA31173

Marking scheme & solution:

Q1. a) I

$S_{11} = \left[\int_{\langle T \rangle} s_1^2(t)\, dt \right]^{1/2}$

$u_1(t) = s_1(t) / S_{11}$

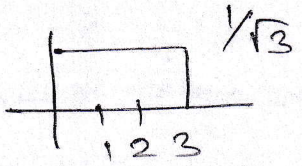
$S_{21} = \int_{\langle T \rangle} s_2(t) \cdot u_1(t)$

$S_{22} = \left\{ \int_{\langle T \rangle} [s_2(t) - S_{21} u_1(t)]^2 dt \right\}^{1/2}$

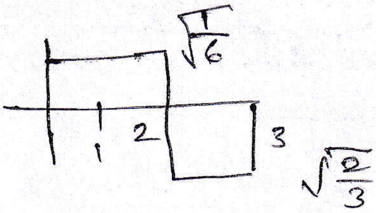
$u_2(t) = \frac{1}{S_{22}} [s_2(t) - S_{21} u_1(t)]$ — 3 Marks

II

$u_1(t) \Rightarrow$



$u_2(t) \Rightarrow$



— 3 Marks

Q1 b) Importance - 2 Marks

classification 4 Marks

Q1 c) cross correlation

1) $0 \le \tau \le 3$ $\int_{\tau}^{3} 2t\, dt = 9 - \tau$ — 1 Marks

2) $-2 \le \tau \le 0$ $\int_{0}^{3} 2t\, dt = 9$ — 1 Marks

3) $-5 \le \tau \le -2$ $\int_{0}^{\tau+5} 2t\, dt = \tau^2 + 10\tau + 25$ 2 Marks

Q2 a)

1) Energy of signal

$$\int_{-\infty}^{\infty} |M(f)|^2 \, df = \int_{-1}^{1} (1-f)^2 \, df$$

$$= 2 \int_{0}^{1} (1-f)^2 \, df = \frac{2}{3} \text{ Jouls}$$ - 3 Marks

2) Half energy frequency f_1

$$\int_{-f_1}^{f_1} (1-f)^2 \, df = \frac{1}{2} \cdot \frac{2}{3} = \frac{1}{3}$$

$$\therefore \int_{0}^{f_1} (1-f)^2 \, df = \frac{1}{6}$$ - 3 Marks

Solving this approx value of $f_1 = 0.21$

(Marks to be given to the ~~step~~ correct steps/ approach to solve the problem)

b) PSD definition - 2 Marks

Importance - 01 Marks

relation between I/p & o/p - 3 Marks

c) Voltage gain in dB -10 - 2 marks

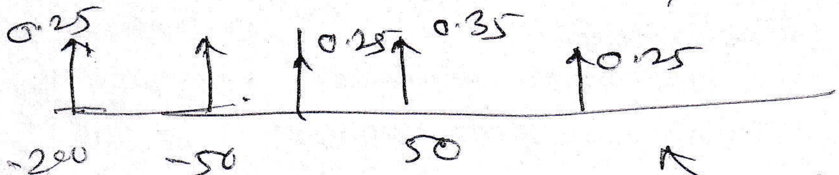
Power gain 0.01 2 Marks

Q 3) freq^n components present in the signal

$$x(t) = 0.7 \cos(100\pi t) + 0.5 \cos^2(200\pi t)$$

$$= 0.7 \cos(100\pi t) + 0.5 \frac{(1 + \cos(2 \cdot 200\pi t))}{2}$$

1) 50 Hz, 0.2 dc, 200 Hz



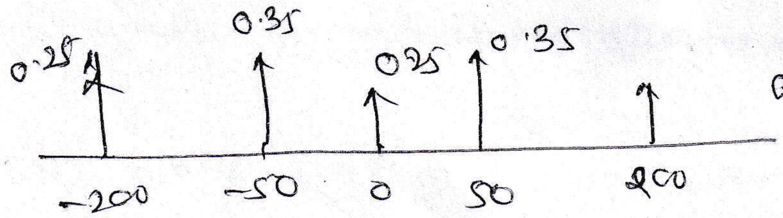
sampling freq^n

$f_s = 400$ Hz - 2 Marks

2 Marks.

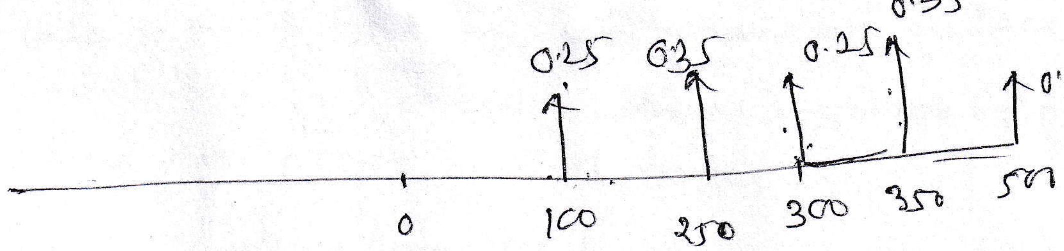
∴ New sampling freq^n is $0.75 f_s = 300$ Hz

spectrum of sampled signal



+

modulated on f_s



complete spectrum is addition of original + modulated on f_s

folding freq^n is 150 Hz = $\frac{f_s}{2}$

freq^n comp 100 Hz which is aliased of 200 Hz

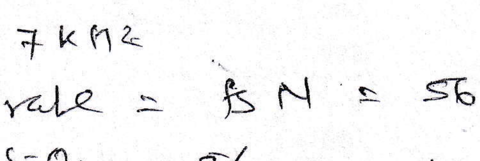
— 2 marks

b) block diagram. 2 marks

importance of functionality 2 marks

c) If $2M < S$ then it will results granular noise

2 marks



+ 2 marks, along with explanation

Q 4. a).

$f_s = 7$ kHz

data rate = $f_s N$ = 56 k samples/sec 2 marks

$\Delta V = \frac{5 - 0}{2^N} = 5/256 = 19$ mV

$P_{Nq} = \frac{(\Delta V)^2}{12} = 3.178 \times 10^{-5}$ watt — 2 marks

$\Delta V_{PCM} = \Delta V_{DPCM}$

$\frac{5}{} \quad \frac{0.9}{}$ solving this $N2 = 6$ bits — 2 marks

Q4 b) Importance of companding - 2 marks

characteristics + explanation about how it is useful (non-uniform quantization) 2 marks

Q4 c) DM block diagram. Slope overload error 3 marks

Data rate increases when we reduce granular noise keeping slope overload error should not occur. - 1 marks.

—— End ——

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